

CLAIMS

1. A communication station for receiving a desired signal via an antenna disposable at a skew angle to receive the desired signal, the communication station comprising:

a control unit comprising:

a memory containing data structures comprising a tuning module configured to determine a first vector corresponding to communication of the antenna with a first transmitter and a second vector corresponding to communication of the antenna with a second transmitter; and

a motor controller electrically coupled to the memory to trigger orientation of the antenna to permit communication with the first and second transmitters via the first and second vectors to facilitate determination of the skew angle.

2. The communication station of claim 1, further comprising the antenna.

3. The communication station of claim 2, wherein the control unit further comprises a motor assembly controllable by the motor controller to pivot the antenna about an elevation axis and an azimuth axis to orient the antenna to communicate with the first transmitter, wherein the motor assembly is further configured to pivot the antenna about a skew axis to align the antenna with the skew angle.

1           4.       The communication station of claim 2, wherein the antenna is shaped to  
2 reflect a first signal from the first transmitter, the communication station further  
3 comprising a first LNB disposed to receive the first signal after reflection from the  
4 antenna.

5  
6           5.       The communication station of claim 4, wherein the data structures further  
7 comprise a vector manipulation module configured to mathematically process the first  
8 and second vectors to obtain a third vector extending between the first and second  
9 transmitters, wherein the skew angle is derived from the third vector.

10  
11           6.       The communication station of claim 5, wherein the desired signal is to be  
12 received from the first transmitter, the first transmitter comprising a first dish, wherein  
13 the data structures further comprise an arc adjustment module configured to offset the  
14 third vector to provide the skew angle such that, when the antenna is disposed at the skew  
15 angle, the antenna is substantially parallel to the first dish.

16  
17           7.       The communication station of claim 4, further comprising a second LNB  
18 disposed to receive a second signal from the second transmitter after reflection of the  
19 second signal from the antenna, wherein the first and second LNB's are relatively  
20 disposed such that the antenna is able to simultaneously receive the first and second  
21 signals via the first and second LNB's, respectively.

1           8.     The communication station of claim 7, wherein the tuning module is  
2 configured to communicate with the motor controller to pivot the antenna about the  
3 elevation and azimuth axes to obtain the first vector, and then exclusively about the skew  
4 axis to simultaneously obtain the second vector and dispose the antenna at the skew  
5 angle.

6  
7           9.     The communication station of claim 1, further comprising a sensor array  
8 coupled to the antenna to provide location and orientation data to the control unit.

9  
10          10.    The communication station of claim 9, wherein the data structures further  
11 comprise a window acquisition module configured to receive the location and orientation  
12 data and to utilize the location and orientation data to obtain a first window, within which  
13 the first vector is disposed, and a second window, within which the second vector is  
14 disposed.

15  
16          11.    The communication station of claim 10, wherein the tuning module  
17 receives the first and second windows and initiates motion of the antenna to receive a  
18 first signal and a second signal from within the first and second windows, respectively,  
19 wherein the tuning module receives signal strength data from within the first and second  
20 windows to find vectors along which signal strength is maximized within the first and  
21 second windows, thereby determining the first and second vectors, respectively.

1           12.     The communication station of claim 9, wherein the sensor array comprises  
2 a global positioning satellite (GPS) receiver, a level, a tilt indicator, and a compass, the  
3 communication station further comprising a first LNB configured to receive the desired  
4 signal and convert the desired signal into an analog signal, a splitter configured to convey  
5 the analog signal to the control unit and to a modem configured to convert the analog  
6 signal to a digital signal, and a computer coupled to the modem to receive the digital  
7 signal.

8  
9           13.     The communication station of claim 1, wherein the first transmitter  
10 comprises a first satellite and the second transmitter comprises a second satellite, wherein  
11 the first satellite comprises a first dish oriented substantially perpendicular to the first  
12 vector and the second satellite comprises a second dish oriented substantially  
13 perpendicular to the second vector, wherein the tuning module is configured to orient the  
14 antenna substantially parallel to the first dish to enable communication of the antenna  
15 with the first satellite and to orient the antenna substantially parallel to the second dish to  
16 enable communication of the antenna with the second satellite.

17  
18           14.     The communication station of claim 13, wherein the second satellite is  
19 displaced from the first satellite by at least fifteen degrees with respect to the antenna.

1           15.    A communication station for receiving a desired signal via an antenna  
2 disposable at a skew angle to receive the desired signal, the communication station  
3 comprising:

4           a control unit comprising:

5               a memory containing data structures comprising:

6                   a tuning module configured to determine a first vector  
7 corresponding to communication of the antenna with a first transmitter and  
8 a second vector corresponding to communication of the antenna with a  
9 second transmitter; and

10               a vector manipulation module configured to process the first and  
11 second vectors to determine the skew angle.  
12

13           16.    The communication station of claim 15, wherein the first transmitter  
14 comprises a first satellite and the second transmitter comprises a second satellite, wherein  
15 the first satellite comprises a first dish and the second satellite comprises a second dish,  
16 wherein the control unit further comprises a motor controller electrically coupled to the  
17 memory to trigger orientation of the antenna substantially parallel to the first dish to  
18 permit communication of the antenna with the first satellite and to trigger orientation of  
19 the antenna substantially parallel to the second dish to permit communication of the  
20 antenna with the second satellite.  
21

22           17.    The communication station of claim 16, wherein the vector manipulation  
23 module is configured to determine a third vector extending between the first and second  
24 satellites.

1           18.     The communication station of claim 17, wherein the desired signal is to be  
2 received from the first satellite, the data structures further comprising an arc adjustment  
3 module configured to offset the third vector to provide the skew angle such that, when the  
4 antenna is disposed at the skew angle, the antenna is substantially parallel to the first  
5 dish.

6  
7           19.     The communication station of claim 17, wherein the desired signal is to be  
8 received from a third satellite disposed generally midway between the first and second  
9 satellites such that the third vector provides the skew angle substantially without  
10 adjustment.

11  
12           20.     The communication station of claim 15, further comprising the antenna, a  
13 sensor array coupled to the antenna to provide location and orientation data to the control  
14 unit, and a motor assembly controllable by the motor controller to pivot the antenna about  
15 an elevation axis, an azimuth axis, and a skew axis.

1           21.     The communication station of claim 20, wherein the data structures further  
2     comprise a window acquisition module configured to receive the location and orientation  
3     data and to utilize the location and orientation data to obtain a first window, within which  
4     the first vector is disposed, and a second window, within which the second vector is  
5     disposed, wherein the tuning module receives the first and second windows and initiates  
6     motion of the antenna to receive a first and second signals from within the first and  
7     second windows, respectively, wherein the tuning module receives signal strength data  
8     from within the first and second windows to find vectors along which the signal strength  
9     is maximized within the first and second windows, thereby determining the first and  
10    second vectors, respectively.

1           22.     A cross polarization system for facilitating receipt of a desired signal by  
2 an antenna, the cross polarization system comprising:

3           a window acquisition module configured to establish a first window and a second  
4 window, with respect to the antenna; and

5           a tuning module configured to determine a first vector within the first window, the  
6 first vector corresponding to communication of the antenna with a first transmitter, and a  
7 second vector within the second window, the second vector corresponding to  
8 communication of the antenna with a second transmitter, to facilitate determination of a  
9 skew angle at which the antenna is disposable to cross polarize the antenna with respect  
10 to the desired signal  
11

12           23.     The cross polarization system of claim 22, wherein the tuning module  
13 receives the first and second windows and initiates motion of the antenna to receive  
14 signals from within the first and second windows, wherein the tuning module receives  
15 signal strength data from within the first and second windows to find vectors along which  
16 the signal strength is maximized within the first and second windows, thereby  
17 determining the first and second vectors, respectively.  
18

19           24.     The cross polarization system of claim 23, further comprising a vector  
20 manipulation module configured to mathematically process the first and second vectors  
21 to obtain a third vector extending between the first and second transmitters, wherein the  
22 skew angle is derived from the third vector.



1           25.     The cross polarization system of claim 23, wherein the tuning module is  
2 configured to communicate with the motor controller to pivot the antenna about the  
3 elevation and azimuth axes to obtain the first vector, and then exclusively about the skew  
4 axis to simultaneously obtain the second vector and dispose the antenna at the skew  
5 angle.

1           26.    A method for receiving a desired signal via an antenna, the method  
2 comprising:

3               aligning the antenna to receive a first signal from a first transmitter;  
4               aligning the antenna to receive a second signal from a second transmitter; and  
5               receiving the desired signal with the antenna disposed at a skew angle obtained  
6 via alignment of the antenna with the first and second transmitters.

7  
8           27.    The method of claim 26, wherein aligning the antenna to receive the first  
9 signal comprises pivoting the antenna about an elevation axis and an azimuth axis to  
10 orient the antenna to communicate with the first transmitter, the method further  
11 comprising pivoting the antenna about a skew axis to dispose the antenna at the skew  
12 angle prior to reception of the desired signal with the antenna disposed at the skew angle.

13  
14           28.    The method of claim 26, wherein the antenna is shaped to reflect the first  
15 signal from the first transmitter, wherein aligning the antenna to receive the first signal  
16 comprises receiving the first signal with a first LNB after reflection of the first signal  
17 from the antenna.

1           29.     The method of claim 28, further comprising:  
2           obtaining a first vector corresponding to communication of the antenna with the  
3 first transmitter;  
4           obtaining a second vector corresponding to communication of the antenna with  
5 the second transmitter;  
6           mathematically processing the first and second vectors to obtain a third vector  
7 extending between the first and second transmitters; and  
8           deriving the skew angle from the third vector.  
9

10          30.     The method of claim 29, wherein the desired signal is to be received from  
11 the first transmitter, the first transmitter comprising a first dish, the method further  
12 comprising offsetting the third vector to provide the skew angle such that, when the  
13 antenna is disposed at the skew angle, the antenna is substantially parallel to the first  
14 dish.  
15

16          31.     The method of claim 28, wherein aligning the antenna to receive the  
17 second signal comprises receiving the second signal with a second LNB after reflection  
18 of the second signal from the antenna, wherein the first and second LNB's are relatively  
19 disposed such that the antenna is able to simultaneously receive the first and second  
20 signals via the first and second LNB's, respectively.

1           32.     The method of claim 31, wherein aligning the antenna to receive the first  
2 signal comprises pivoting the antenna about the elevation and azimuth axes to obtain the  
3 first vector, wherein aligning the antenna to receive the second signal comprises pivoting  
4 the antenna exclusively about the skew axis to simultaneously obtain the second vector  
5 and dispose the antenna at the skew angle.  
6

7           33.     The method of claim 26, wherein aligning the antenna to receive the first  
8 signal comprises receiving location and orientation data from a sensor array coupled to  
9 the antenna and utilizing the location and orientation data to obtain a first window, within  
10 which the first vector is disposed, and wherein aligning the antenna to receive the second  
11 signal comprises utilizing the location and orientation data to obtain a second window,  
12 within which the second vector is disposed.  
13

14           34.     The method of claim 33, wherein aligning the antenna to receive the first  
15 signal comprises moving the antenna to receive the first signal from within the first  
16 window, and receiving signal strength data from within the first window to find a vector  
17 within the first window along which signal strength is maximized, thereby determining  
18 the first vector, wherein aligning the antenna to receive the second signal comprises  
19 moving the antenna to receive the second signal from within the second window and  
20 receiving signal strength data from within the second window to find a vector within the  
21 second window along which signal strength is maximized, thereby determining the  
22 second vector.

1           35.     The method of claim 26, wherein the first transmitter comprises a first  
2 satellite comprising a first dish and the second transmitter comprises a second satellite  
3 comprising a second dish, wherein aligning the antenna to receive the first signal  
4 comprises orienting the antenna substantially parallel to the first dish to enable  
5 communication of the antenna with the first satellite, wherein aligning the antenna to  
6 receive the second signal comprises orienting the antenna substantially parallel to the  
7 second dish to enable communication of the antenna with the second satellite.

8  
9           36.     The method of claim 35, wherein the second satellite is displaced from the  
10 first satellite by at least fifteen degrees with respect to the antenna.

1           37. A method for cross polarizing a desired signal with an antenna, the  
2 method comprising:

3           determining a first vector corresponding to communication of the antenna with a  
4 first transmitter;

5           determining a second vector corresponding to communication of the antenna with  
6 a second transmitter; and

7           obtaining a skew angle for the antenna based on the first and second vectors.  
8

9           38. The method of claim 37, wherein the first transmitter comprises a first  
10 satellite comprising a first dish and the second transmitter comprises a second satellite  
11 comprising a second dish, wherein determining the first vector comprises orienting the  
12 antenna substantially parallel to the first dish to permit communication of the antenna  
13 with the first satellite, wherein determining the second vector comprises orienting the  
14 antenna substantially parallel to the second dish to permit communication of the antenna  
15 with the second satellite.  
16

17           39. The method of claim 38, wherein obtaining the skew angle for the antenna  
18 comprises determining a third vector extending between the first and second satellites.  
19

20           40. The method of claim 39, wherein the desired signal is to be received from  
21 the first satellite, wherein obtaining the skew angle for the antenna comprises offsetting  
22 the third vector to provide the skew angle such that, when the antenna is disposed at the  
23 skew angle, the antenna is substantially parallel to the first dish.

1           41.     The method of claim 39, wherein the desired signal is to be received from  
2 a third satellite disposed generally midway between the first and second satellites such  
3 that the third vector provides the skew angle substantially without adjustment.

4  
5           42.     The method of claim 37, further comprising:  
6 receiving location and orientation data from a sensor array coupled to the antenna;  
7 and  
8 utilizing the location and orientation data to obtain a first window, within which  
9 the first vector is disposed, and a second window, within which the second vector is  
10 disposed;

11 wherein determining the first vector comprises receiving the first window,  
12 moving the antenna to receive a first signal from within the first window, and receiving  
13 signal strength data from within the first window to find a vector along which signal  
14 strength is maximized within the first window to determine the first vector;

15 wherein determining the second vector comprises receiving the second window,  
16 moving the antenna to receive a second signal from within the second window, and  
17 receiving signal strength data from within the second window to find a vector along  
18 which signal strength is maximized within the second window to determine the second  
19 vector.

1           43.    A method for cross polarizing a desired signal with an antenna, the  
2 method comprising:

3           establishing a first window with respect to the antenna;

4           determining a first vector within the first window, the first vector corresponding  
5 to communication of the antenna with a first transmitter;

6           establishing a second window with respect to the antenna; and

7           determining a second vector within the second window, the second vector  
8 corresponding to communication of the antenna with a second transmitter, to obtain a  
9 skew angle at which the antenna is disposable to cross polarize the antenna with respect  
10 to the desired signal.

11  
12           44.    The method of claim 43, wherein determining the first vector comprises  
13 receiving the first window, initiating motion of the antenna to receive a first signal from  
14 within the first window, and receiving signal strength data from within the first window  
15 to find a vector along which the signal strength is maximized within the first window,  
16 wherein determining the second vector comprises receiving the second window, initiating  
17 motion of the antenna to receive the second signal from within the second window, and  
18 receiving signal strength data from within the second window

19  
20           45.    The method of claim 44, further comprising:

21           mathematically processing the first and second vectors to obtain a third vector  
22 extending between the first and second transmitters; and

23           deriving the skew angle from the third vector.



1           46.    The method of claim 44, wherein determining the first vector comprises  
2 pivoting the antenna about elevation and azimuth axes to obtain the first vector, wherein  
3 determining the second vector comprises pivoting the antenna exclusively about a skew  
4 axis to simultaneously obtain the second vector and dispose the antenna at the skew  
5 angle.

1           47.    A computer readable medium comprising computer code for facilitating  
2 receipt of a desired signal by an antenna, wherein the computer code is configured to  
3 carry out a method comprising:

4           initiating alignment of the antenna to receive a first signal from a first transmitter;  
5           initiating alignment of the antenna to receive a second signal from a second  
6 transmitter; and

7           receiving the desired signal with the antenna disposed at a skew angle obtained  
8 via alignment of the antenna with the first and second transmitters.

9  
10          48.    The computer readable medium of claim 47, wherein the antenna is  
11 shaped to reflect the first signal from the first transmitter, wherein aligning the antenna to  
12 receive the first signal comprises receiving the first signal with a first LNB after  
13 reflection of the first signal from the antenna.

14  
15          49.    The computer readable medium of claim 48, further comprising:  
16 obtaining a first vector corresponding to communication of the antenna with the  
17 first transmitter;

18          obtaining a second vector corresponding to communication of the antenna with  
19 the second transmitter;

20          mathematically processing the first and second vectors to obtain a third vector  
21 extending between the first and second transmitters; and

22          deriving the skew angle from the third vector.

1           50.     The computer readable medium of claim 48, wherein aligning the antenna  
2 to receive the second signal comprises receiving the second signal with a second LNB  
3 after reflection of the second signal from the antenna, wherein the first and second LNB's  
4 are relatively disposed such that the antenna is able to simultaneously receive the first and  
5 second signals via the first and second LNB's, respectively.  
6

7           51.     The computer readable medium of claim 50, wherein aligning the antenna  
8 to receive the first signal comprises pivoting the antenna about the elevation and azimuth  
9 axes to obtain the first vector, wherein aligning the antenna to receive the second signal  
10 comprises pivoting the antenna exclusively about the skew axis to simultaneously obtain  
11 the second vector and dispose the antenna at the skew angle.  
12

13           52.     The computer readable medium of claim 47, wherein aligning the antenna  
14 to receive the first signal comprises receiving location and orientation data from a sensor  
15 array coupled to the antenna and utilizing the location and orientation data to obtain a  
16 first window, within which the first vector is disposed, and wherein aligning the antenna  
17 to receive the second signal comprises utilizing the location and orientation data to obtain  
18 a second window, within which the second vector is disposed.

1           53.     The computer readable medium of claim 52, wherein aligning the antenna  
2 to receive the first signal comprises moving the antenna to receive the first signal from  
3 within the first window, and receiving signal strength data from within the first window  
4 to find a vector within the first window along which signal strength is maximized,  
5 thereby determining the first vector, wherein aligning the antenna to receive the second  
6 signal comprises moving the antenna to receive the second signal from within the second  
7 window and receiving signal strength data from within the second window to find a  
8 vector within the second window along which signal strength is maximized, thereby  
9 determining the second vector.  
10

11           54.     The computer readable medium of claim 47, wherein the first transmitter  
12 comprises a first satellite comprising a first dish and the second transmitter comprises a  
13 second satellite comprising a second dish, wherein aligning the antenna to receive the  
14 first signal comprises orienting the antenna substantially parallel to the first dish to enable  
15 communication of the antenna with the first satellite, wherein aligning the antenna to  
16 receive the second signal comprises orienting the antenna substantially parallel to the  
17 second dish to enable communication of the antenna with the second satellite.